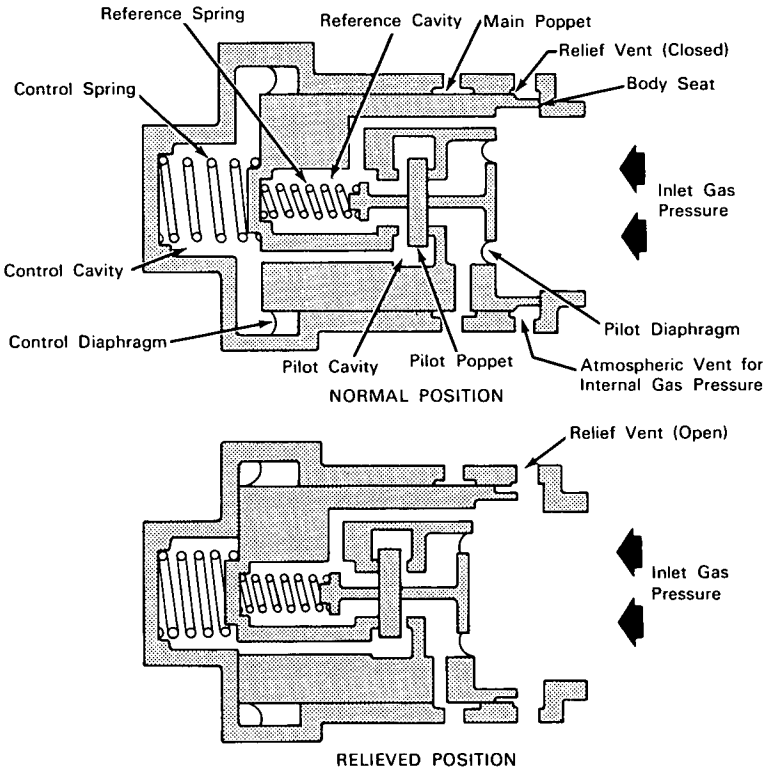
NASA TECH BRIEF

Sensitive Low-Pressure Relief Valve Has Positive Seating Against Leakage



The problem: Providing a sensitive, leakproof, low-pressure relief valve for helium gas in cryogenic systems.

The solution: A lightweight pilot-operated relief valve with only two metal-to-metal seats to minimize external leakage.

How it's done: In the normal position of the valve the main poppet is seated on the body by means of the control spring and the force resulting from the pressure in the control cavity acting on the control diaphragm. The effective area of this diaphragm is greater than the body seating area, so that as long as the pressure in the control cavity equals the inlet pressure, the net force holds the main poppet closed. The pressure to the control cavity is supplied from the inlet pressure through the reference cavity and pilot cavity.

As the inlet pressure increases, a force is applied to the pilot poppet by the pilot diaphragm. The pilot

(continued overleaf)

poppet is held on its seat by the reference spring. When the force, due to increasing pressure, applied by the pilot diaphragm exceeds the reference spring force, the pilot poppet is removed from its normal seat to its shuttled seat. With the pilot poppet in its shuttled position, the pressure in the reference cavity is sealed and the control cavity is vented through the pilot cavity to the atmosphere. The bleeding down of the control cavity reduces the pressure acting on the control diaphragm and results in a reduction of the force holding the main poppet on the body seat. When the force holding the main poppet on its seat is less than the force resulting from the inlet pressure, the main poppet lifts from the seat and excessive inlet pressure is bled from the relief vent. The main poppet will remain open to relieve the gas pressure until the inlet pressure decreases to the point where the reference spring force exceeds the pilot diaphragm force. At this pressure the pilot poppet returns to its normal position. Inlet pressure is now ported through the reference cavity and pilot cavity into the control cavity. The pressure acting on the control diaphragm then closes the main poppet and stops the relieving action.

The principal advantage of this design lies in the fact that the pilot poppet is unaffected by variations in control pressures in the pilot cavity. Thus the pilot action reflects only inlet pressure characteristics and results in a more accurate sensing of inlet pressure conditions.

Note:

Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
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Reference: B64-10278

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated.

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